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The Additive System of Photographic Exposure Computation

This Letter Circular has been prepared by the staff of the NBS Photographic Research Section in response to numerous requests for this information. The data has been taken from the open literature and is brought together in this manner for convenience in determining correct exposure by the new additive system.

By expressing the quantities affecting camera exposure on logarithmic scales, smaller numbers result and computations are simplified. This and closely related systems have been known as "L.V.S." (Light Value System), "E.V.S." (Exposure Value System), or "APEX" (Additive Photographic Exposure System). Correct exposure is obtained when the aperture value A_v , time value T_v , film speed value S_v , and light value L_v are related as follows:

$$A_v + T_v = S_v + L_v = \text{Exposure Value } (E_v)$$

These values are found in the left column of the table. The corresponding quantities on arithmetic scales are in the other columns.

<u>Logarithmic Values</u>	<u>A</u> Aperture (f-number)	<u>T</u> Time (sec.)	<u>S</u> Speed (ASA)	<u>L</u> Light (ft-c)	<u>Light</u> (Descriptive)
0	1	1	3	6	Average home interior
1	1.4	1/2	6	12	Bright home interior
2	2	1/4	12	25	Work areas interior
3	2.8	1/8	25	50	Sports arenas interior
4	4	1/15	50	100	Studio - Photoflood
5	5.6	1/30	100	200	Sunsets
6	8	1/60	200	400	Rainy day
7	11	1/125	400	800	Open shade
8	16	1/250	800	1600	Medium overcast
9	22	1/500	1600	3200	Light overcast
10	32	1/1000	3200	6400	Sunlight - normal scene
11	45	1/2000	6400	12500	Sunlight - bright scene

As an example, given a film with an ASA Speed of 100, illuminance of 3200 foot-candles, a shutter setting of 1/250 sec., what is the correct aperture setting? From the left column, we obtain the following values: $S_v = 5$, $L_v = 9$, and $T_v = 8$.

$$A_v = S_v + L_v - T_v = 5 + 9 - 8 = 6$$

The table shows that an aperture value of 6 corresponds to f/8. As long as this film and this shutter setting are used, the aperture value may be found by subtracting 3 from the light value. The system is most convenient if camera and light meter markings are logarithmic. ASA standards provide that a degree sign, eg. "ASA 5°" shall distinguish logarithmic film speed values from arithmetic speeds, eg. "ASA 100".

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